Status of the Front Tracker GEM and INFN Electronics

2012 – Dec – 12

SBS Weekly Meeting

INFN – Catania, Genova, Bari and Rome

GEM Assembling

SRS – INFN Electronics comparison

CERN Test (with small GEMs)

GEM Assembling

We got:

- 5 GEM foils + 14 Drift foils (Feb/2012)
- Many (all) frames in Spring/2012
- 7 Readout foils + 7 Honeycomb plane (Set/2012)
- Start Assembling in Oct/2012
- Expected 10 new GEM foils before the Christmas break

Assembling Procedure

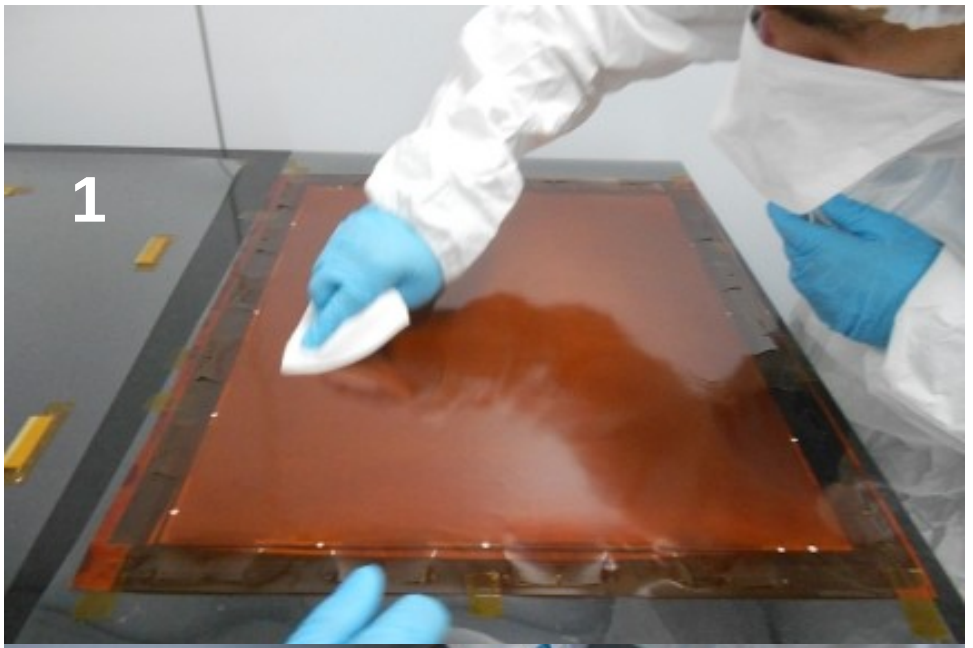
1) Readout foil glued on Honeycomb plane
2) Raw GEM foil HV test
3) Protective resistor soldered in single sector side of the GEM foil
4) GEM foil stretched
5) Frame glued on stretched GEM foil
6) Readout plane glued on framed GEM foil
7) Protective resistors soldered on each GEM sector
8) HV test of the assembled GEM foil
9) Repeat from 2 to 8 for the other 2 GEM foils and the drift foil
10) Glue the last frame and Mylar entrance foil

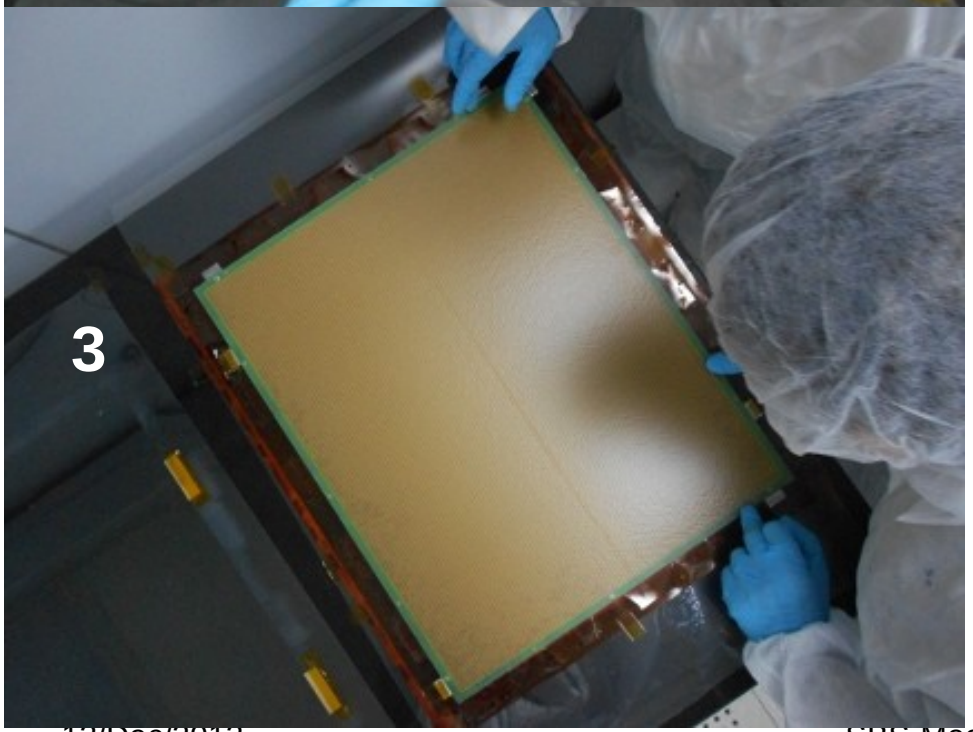
Readout foil visual inspection

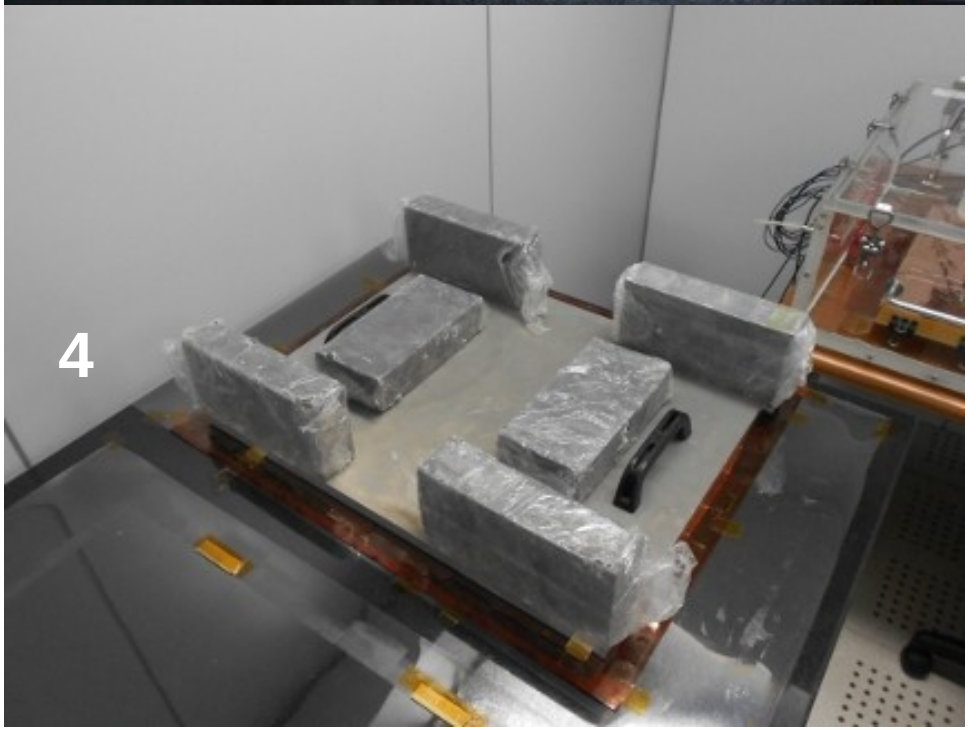
- We observed some defects on the readout

Rui informed about that

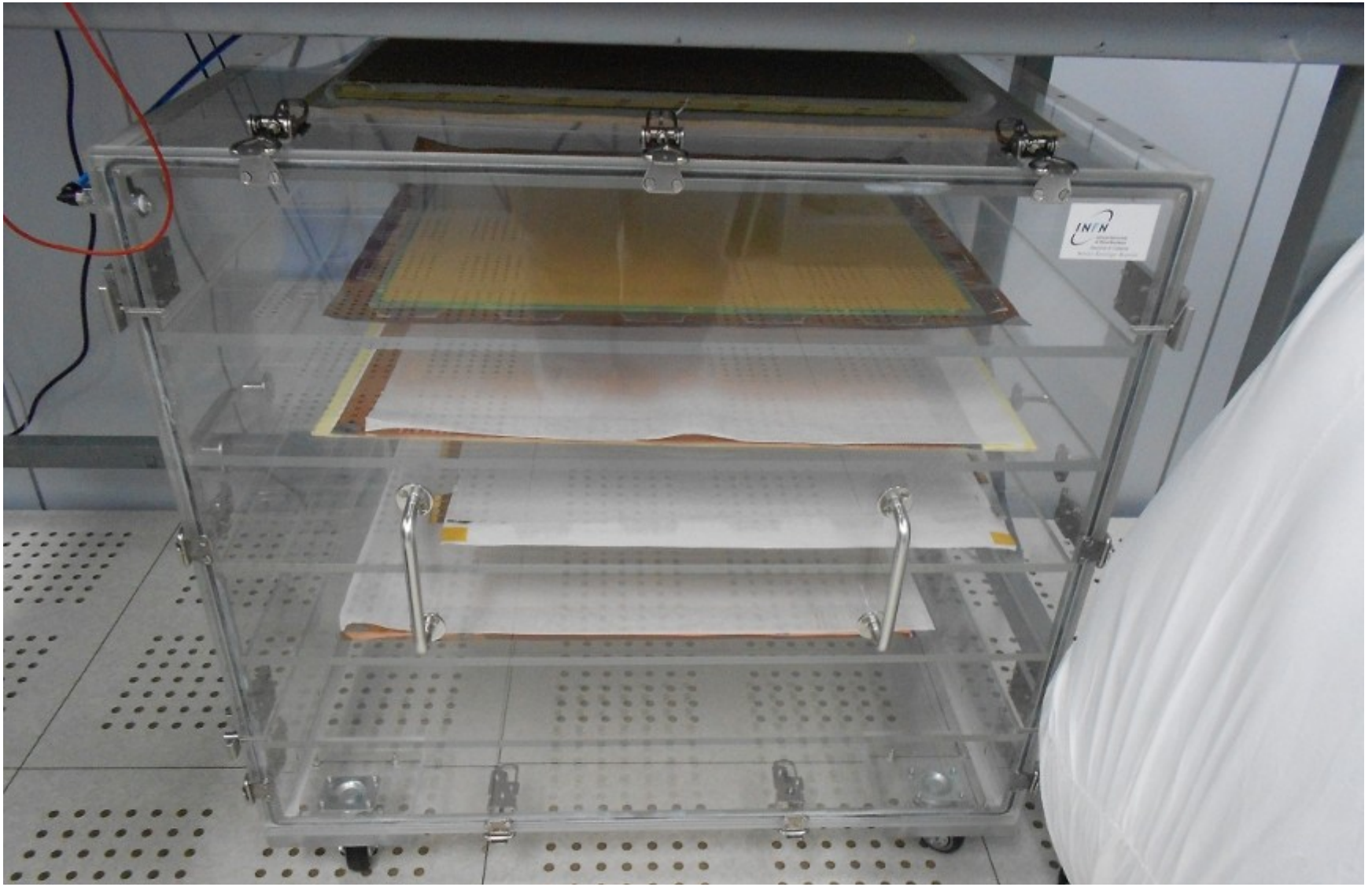
Readout on Honeycomb support



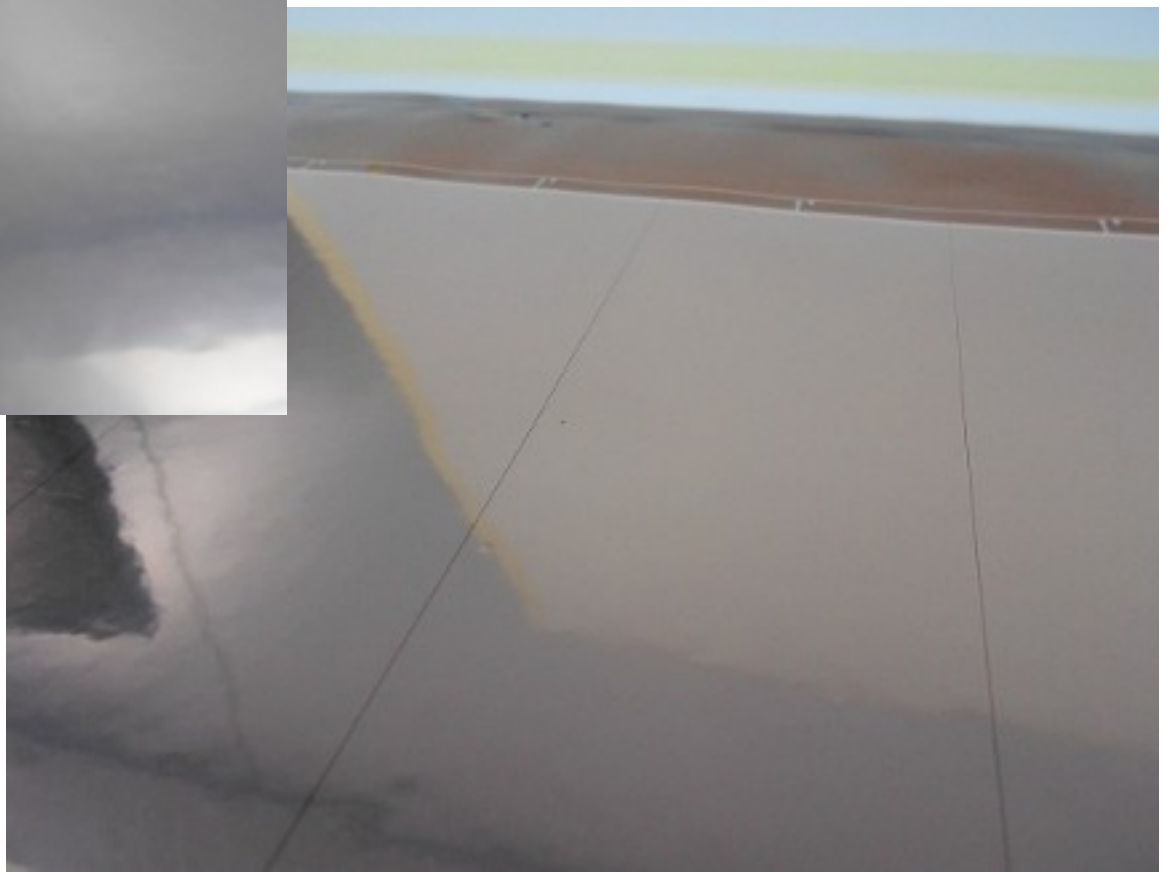




Readout Stored in Cabinet

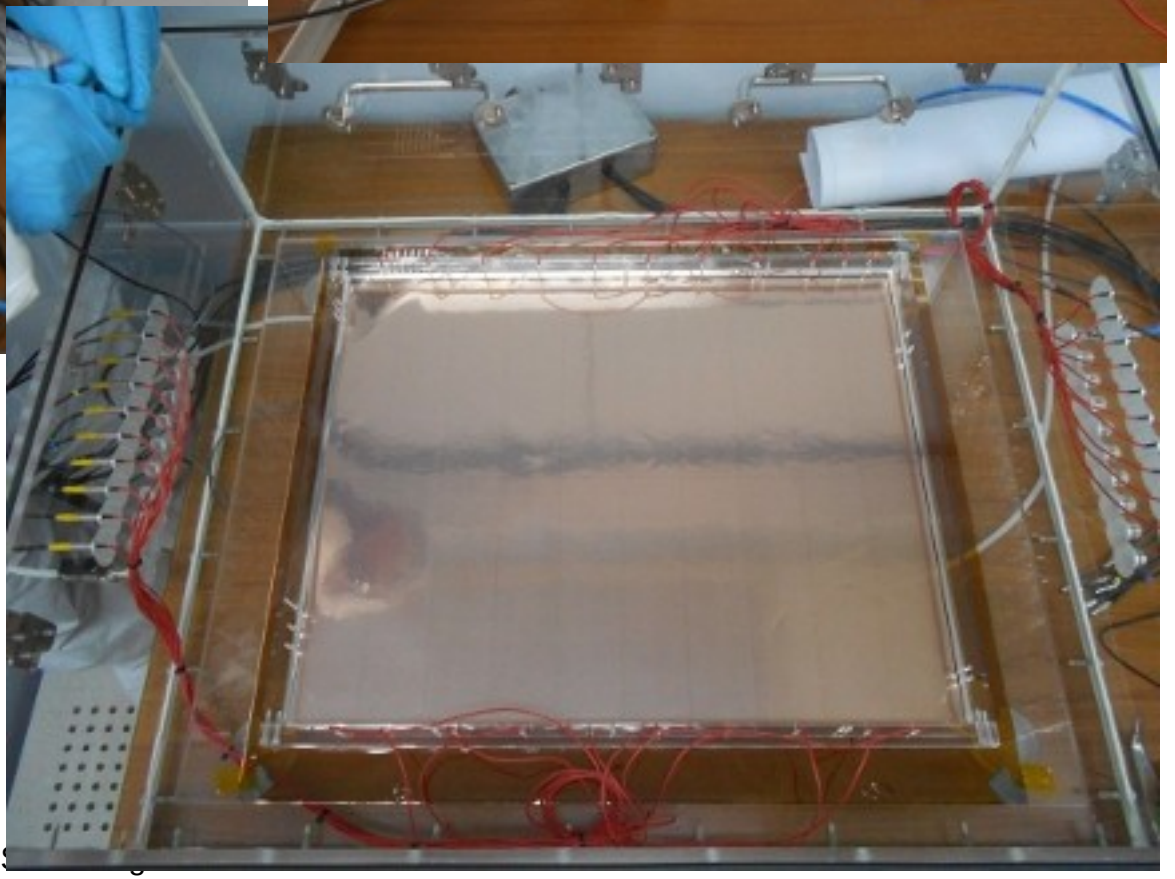


GEM Foil Visual Inspection



- Visually better than previous prototype GEMs
- Apparently minor defects

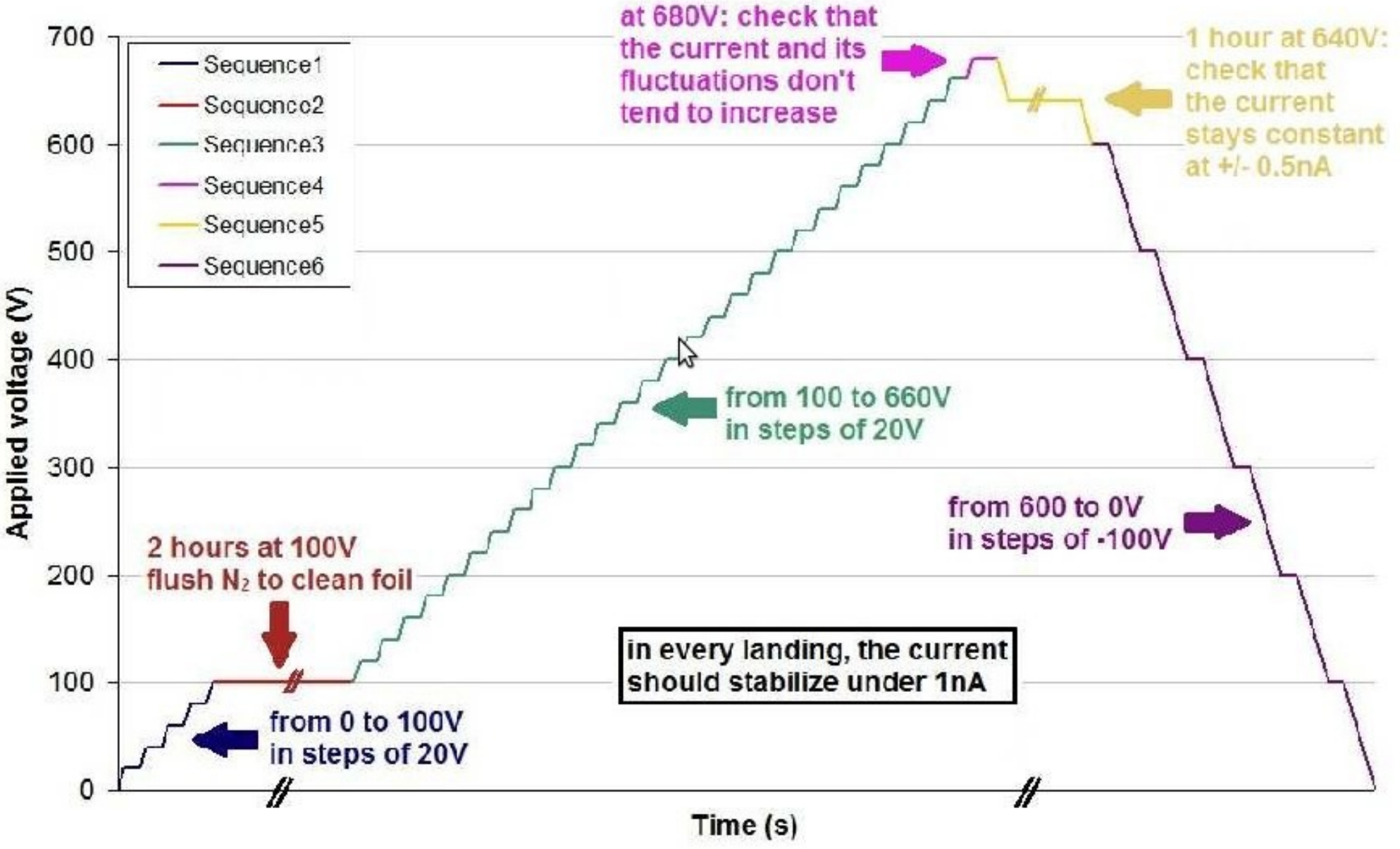
GEM HV Test



Nitrogen filled box

Start ramping up HV
when humidity in box < 10%

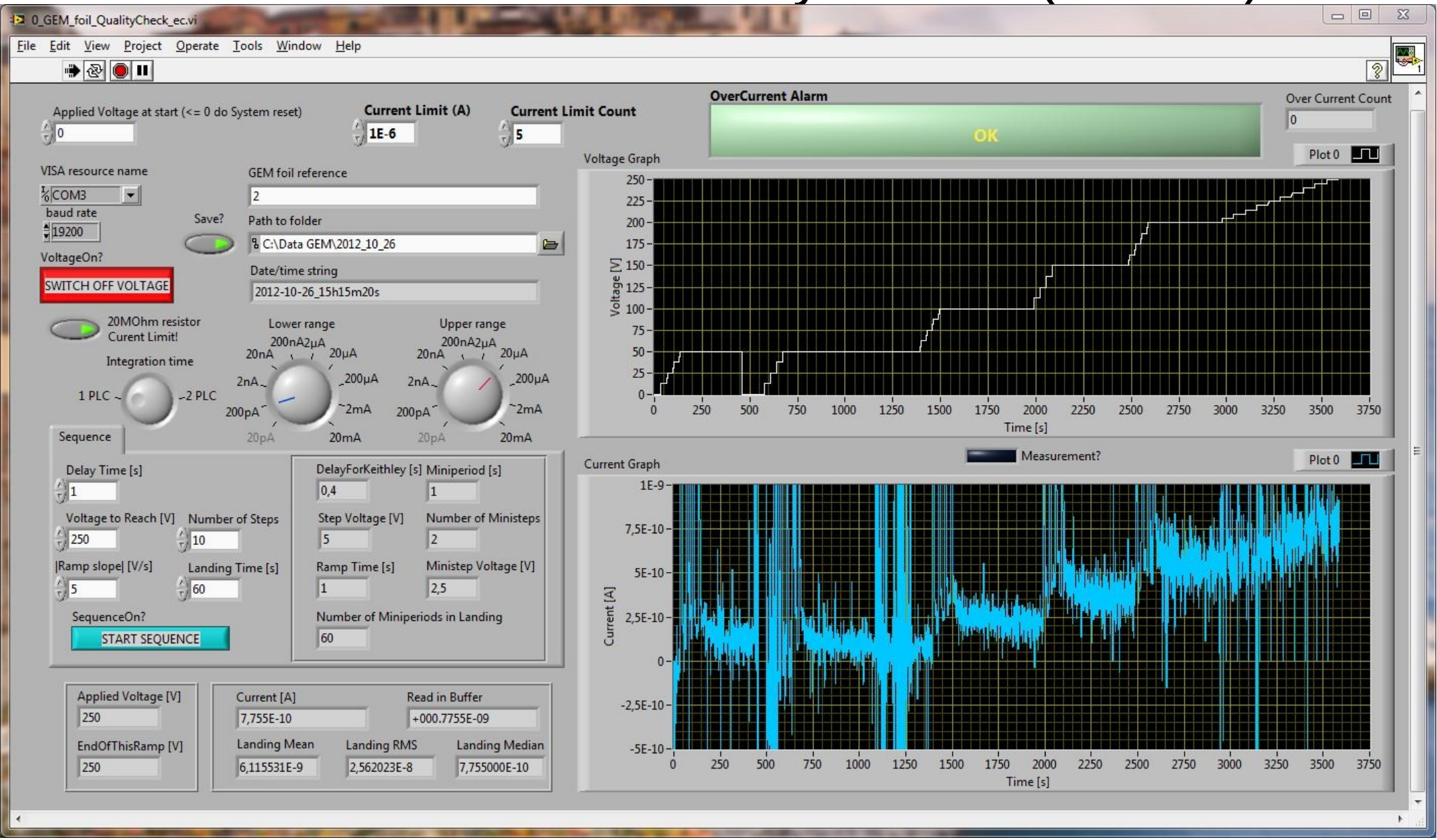
GEM HV Test procedure (plan)



This procedure "worked" for the GEM foil prototypes

GEM HV Test

Current was fine at relatively low HV (<300 V)



GEM HV Test, first results

Hardware limiting current ~3 uA; software 1 uA

- Foil 0:
  - Trip at 280 V → sector 7 with 71 kOhm resistance
  - Decided to move to a new foil
- Foil 1:
  - Trip at 460 V →sector 3 with 21 kOhm
- Foil 2:
  - First trip at 400 V → sector 13 with few kOhm (removed from test)
  - Second trip at 490 V → sector 12 with few kOhm

We decide to change the HV power supply

GEM HV Test, part 2

- Back to Foil 1 (limiting current at 250 nA):
  - Trip at 450 V → sectors 3 and 14 at 97 and 22 kOhm!
  - Trip again at 450 V → sector 19 at 12 kOhm
- Back to Foil 0 (limiting current at 180 nA):
  - Trip at 390 V → sector 14 at 67 kOhm
- We decide to test single sectors and reduce the limiting current to 40 nA
- From now on, we had trips at >520 V but always recovered! But test is very “weak”

HV Test, part 3

Two foils passed the new test procedure (single sector, limiting current 40 nA, no short sectors)

Try to ramp up HV up to 600 V to all sectors simultaneously with limiting current at 1 uA:

Foil 5: lost 3 sectors with few 100 kOhm.

Reduced max HV to 400 V (working HV will be below 350 V) and limiting current at 500 nA:

Foil 4: fine (… **is this test enough ?**)

HV Test / Results

Foil	Bad sectors	Test 1	Test 2	Test 3
0	7, 14	Not passed	-	-
1	3,14,19	Not passed	-	-
2	13,12	Not passed	-	-
3	-	-	passed	Passed (with reduced max I and V)
4	3 sectors with few kOhm	-	passed	Not passed

HV Test – What was wrong ?

Rui suggests to “clean” the foil:

HV to 600 V (single sector) in a quick ramp, limiting current at 2 uA, and keep it for few minutes: dust will vaporize.

We tried with one of the “bad” foil but no success.

Bencivenni/LNF uses a test procedure very similar to our first attempts (limiting current at 5 uA)

Rui informed that the paper foils used to protect the GEM during transportation will be replaced by mylar (or similar) foils to avoid dust in GEM.

The large failure we experienced is puzzling!

Electronics

After the UVa measurements Paolo has analyzed the differences between INFN and SRS electronics.

We basically implemented all of them on cards and on the VME module (MPD):

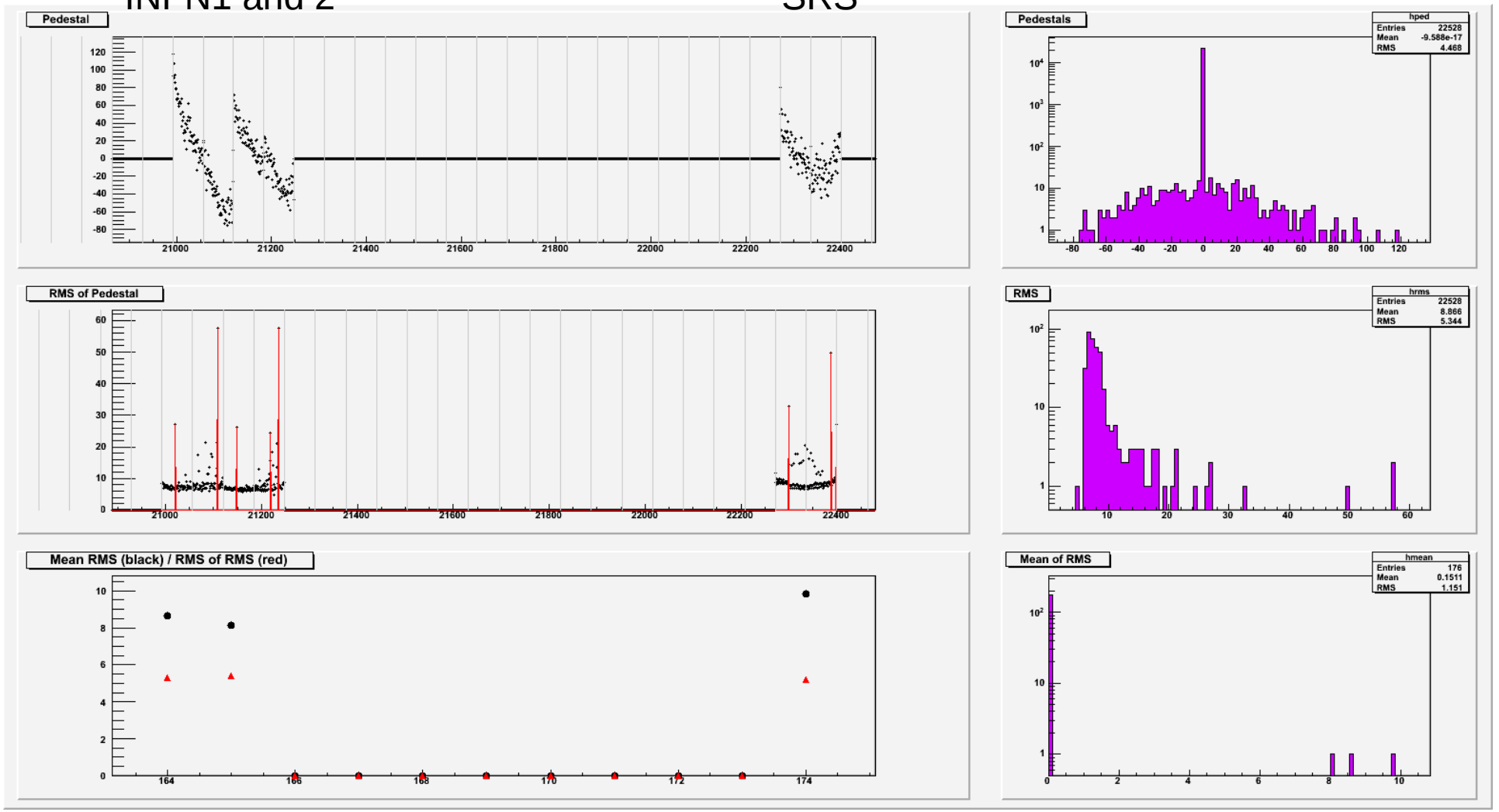
No remarkable effects measured

Paolo has adapted one SRS cards to the INFN-system to proceed with a direct comparison.

INFN – SRS: pedestal noise

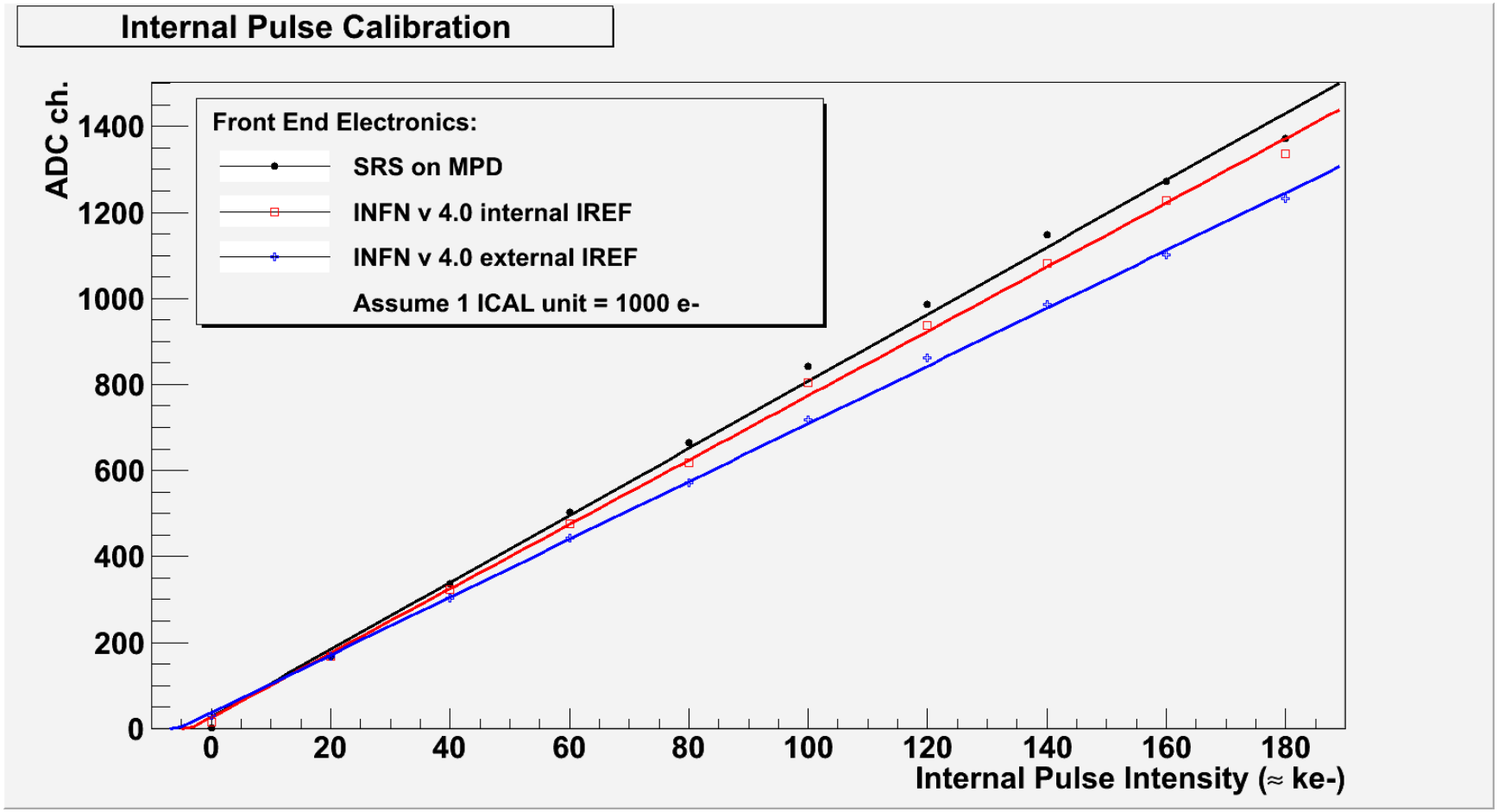
INFN1 and 2

SRS



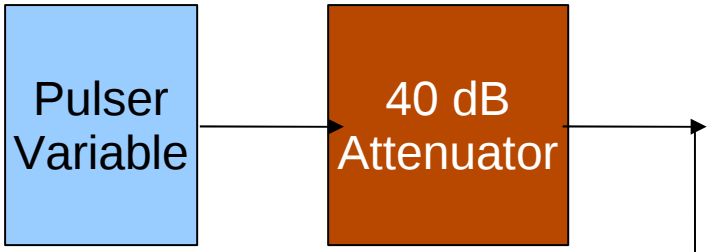
RMS of pedestals very similar

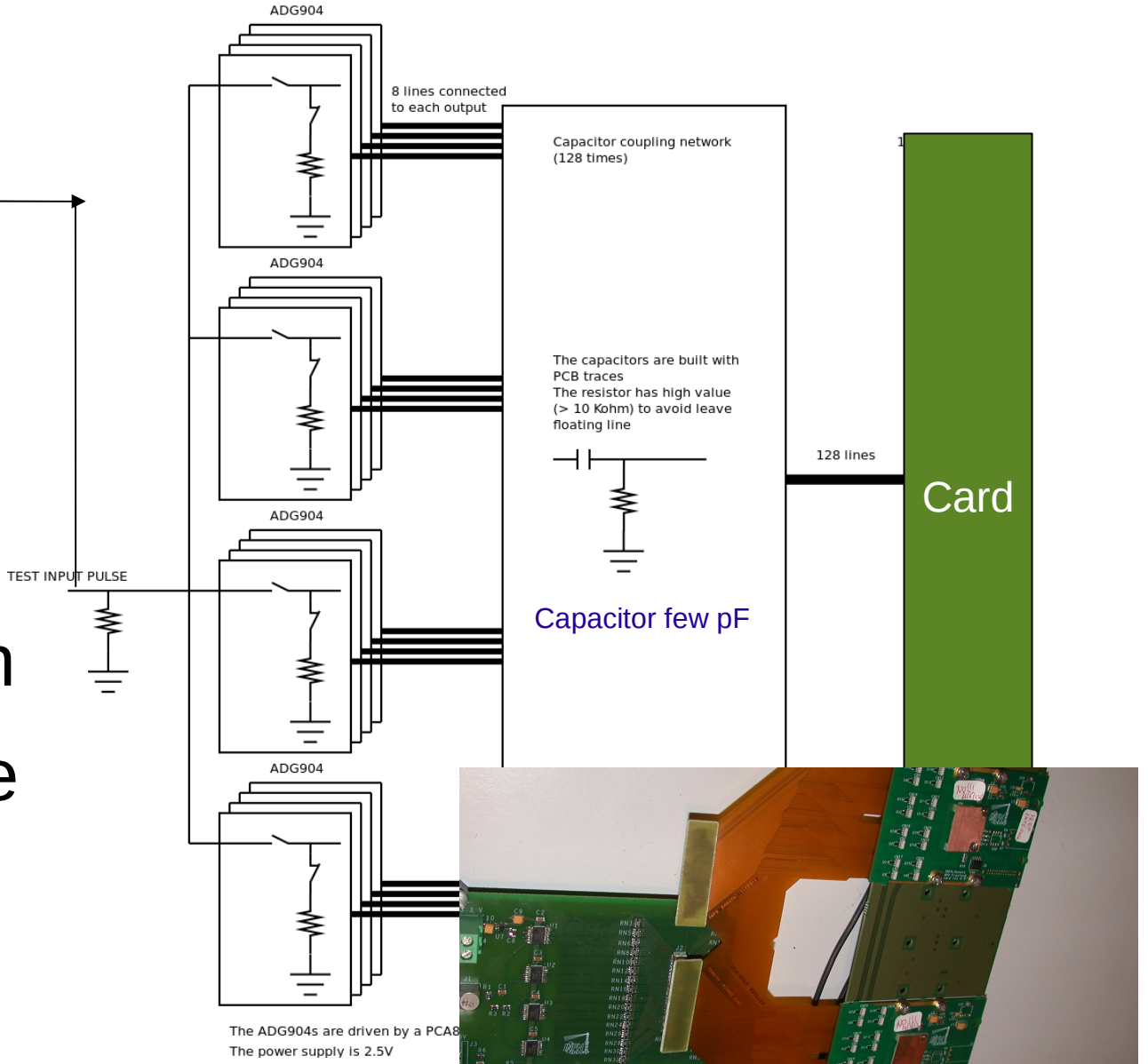
INFN - SRS: internal pulser



SRS slightly higher gain, but probably within cards variability

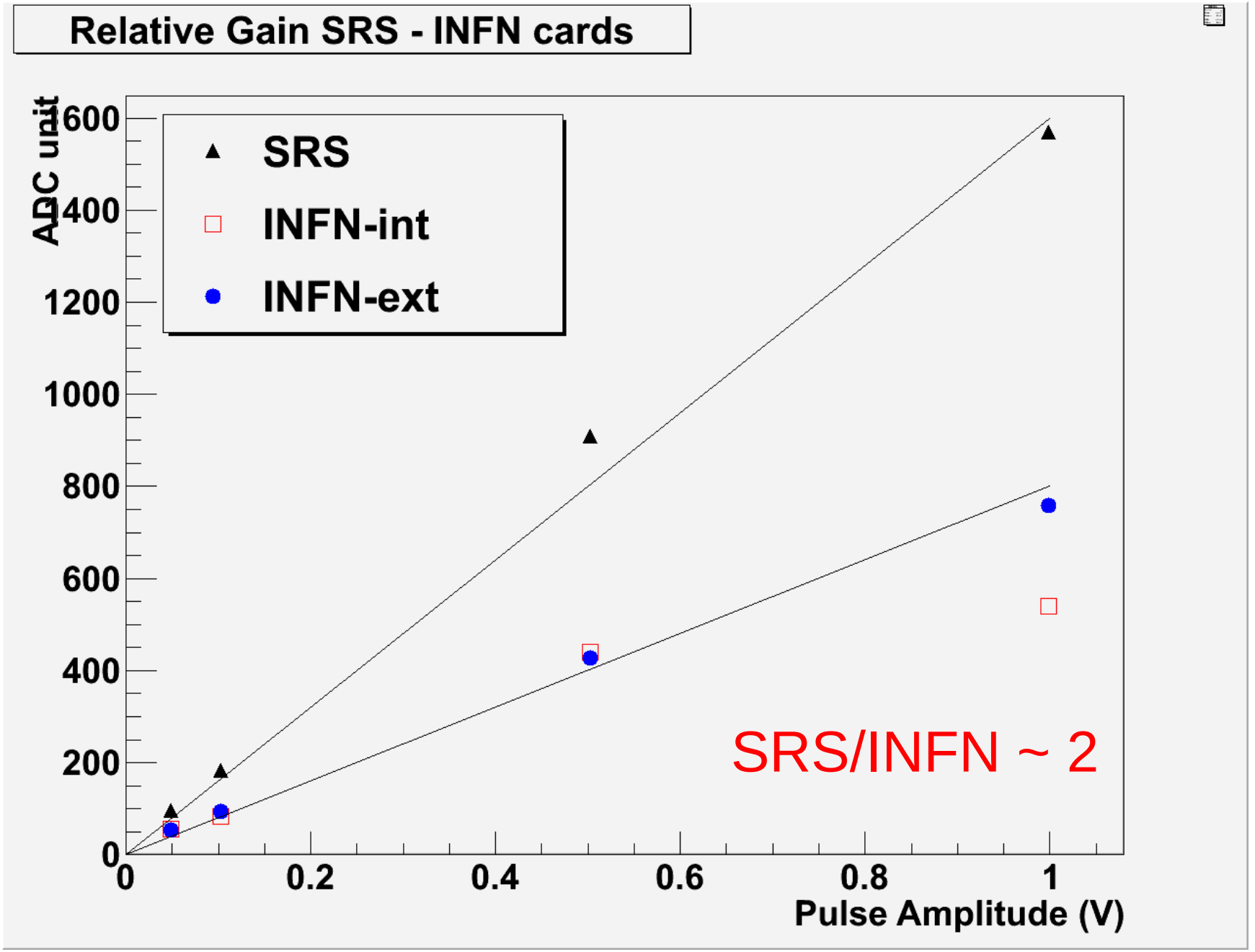
INFN – SRS: external pulse - setup



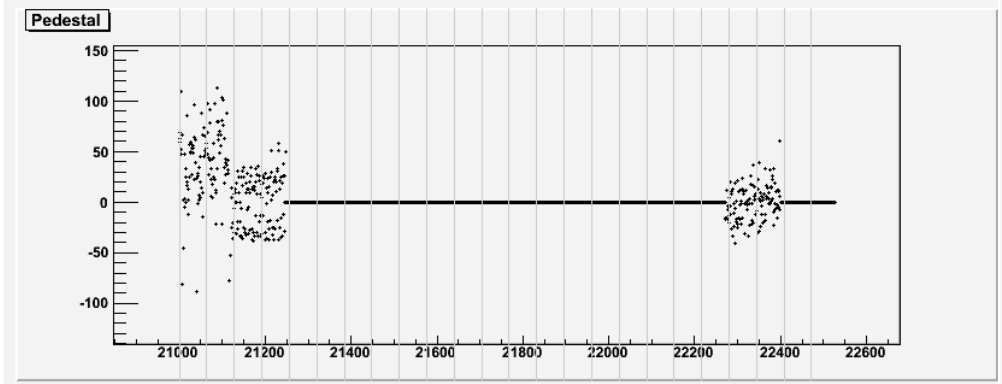


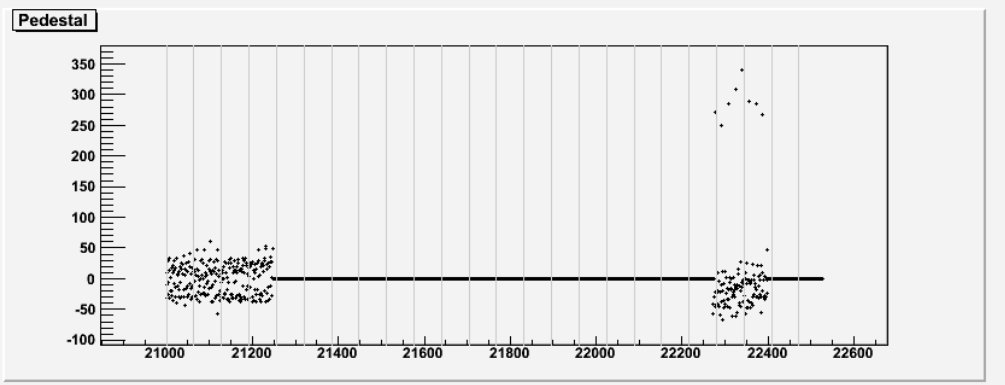
- The ADG904 is basically an electronic multiplexer/switch
- The INFN cards are connected by a kapton adapter
- 8 contiguous strips stimulated

INFN – SRS: external pulse



INFN – SRS: external pulse - noise





Pulse on INFN0

Pulse on SRS

Noise in INFN card larger when test card is connected (next)

INFN – SRS : status

Noise levels of naked cards looks very similar

Noise levels when cards are connected to test board changes

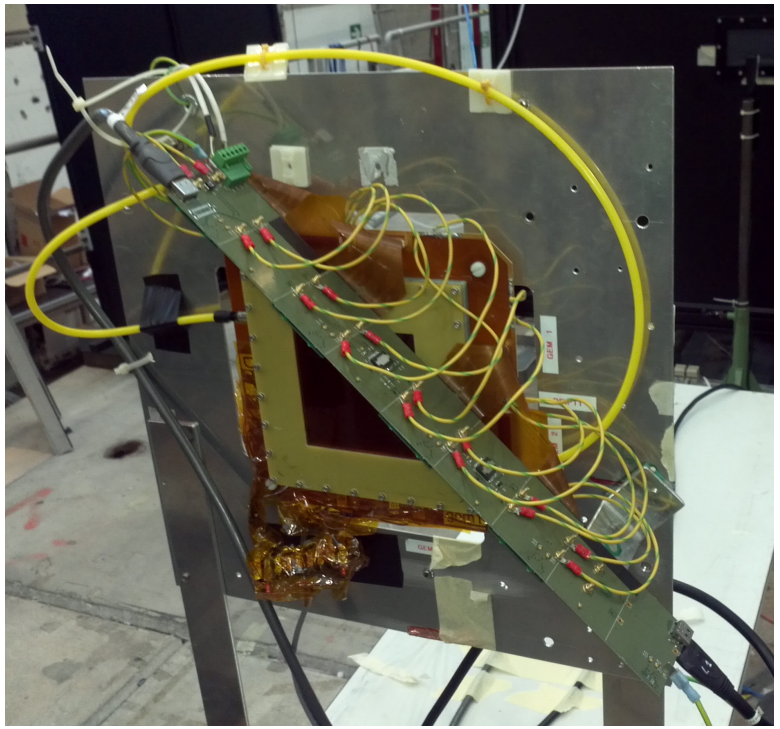
Gain with internal pulse very similar

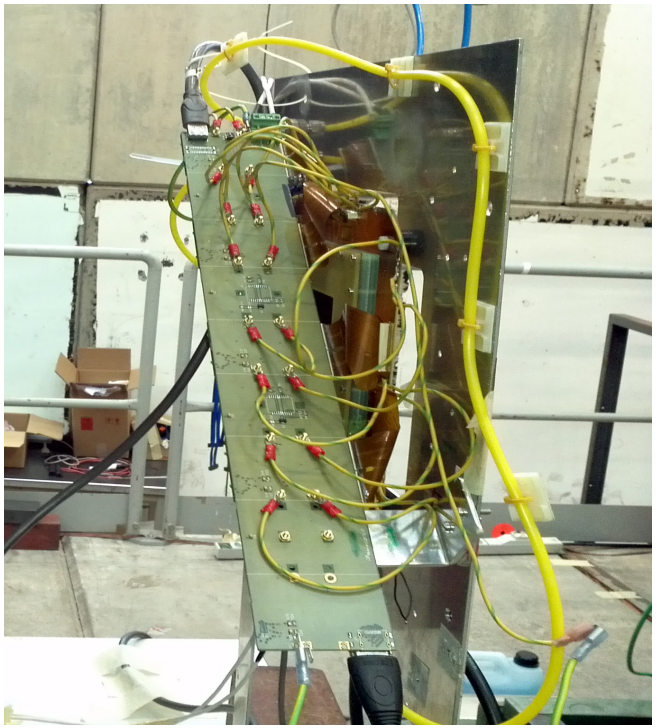
Gain with external pulse factor of 2 better in SRS

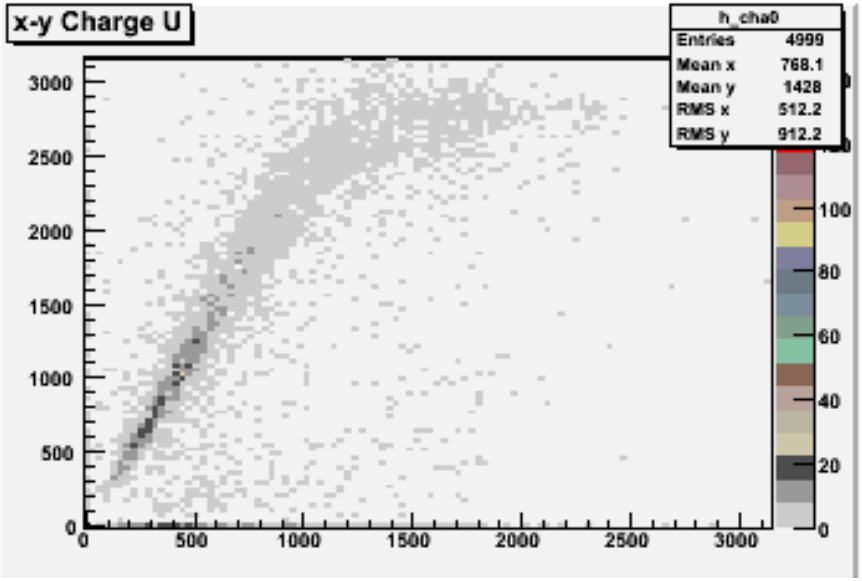
The hardware differences identified up-to-now do not explain difference in sensitivity

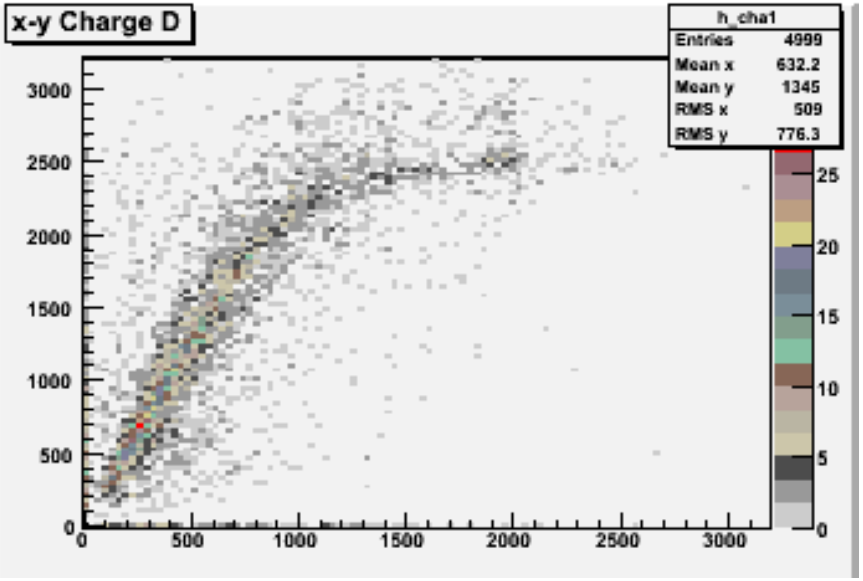
Work is in progress

CERN test: charge sharing

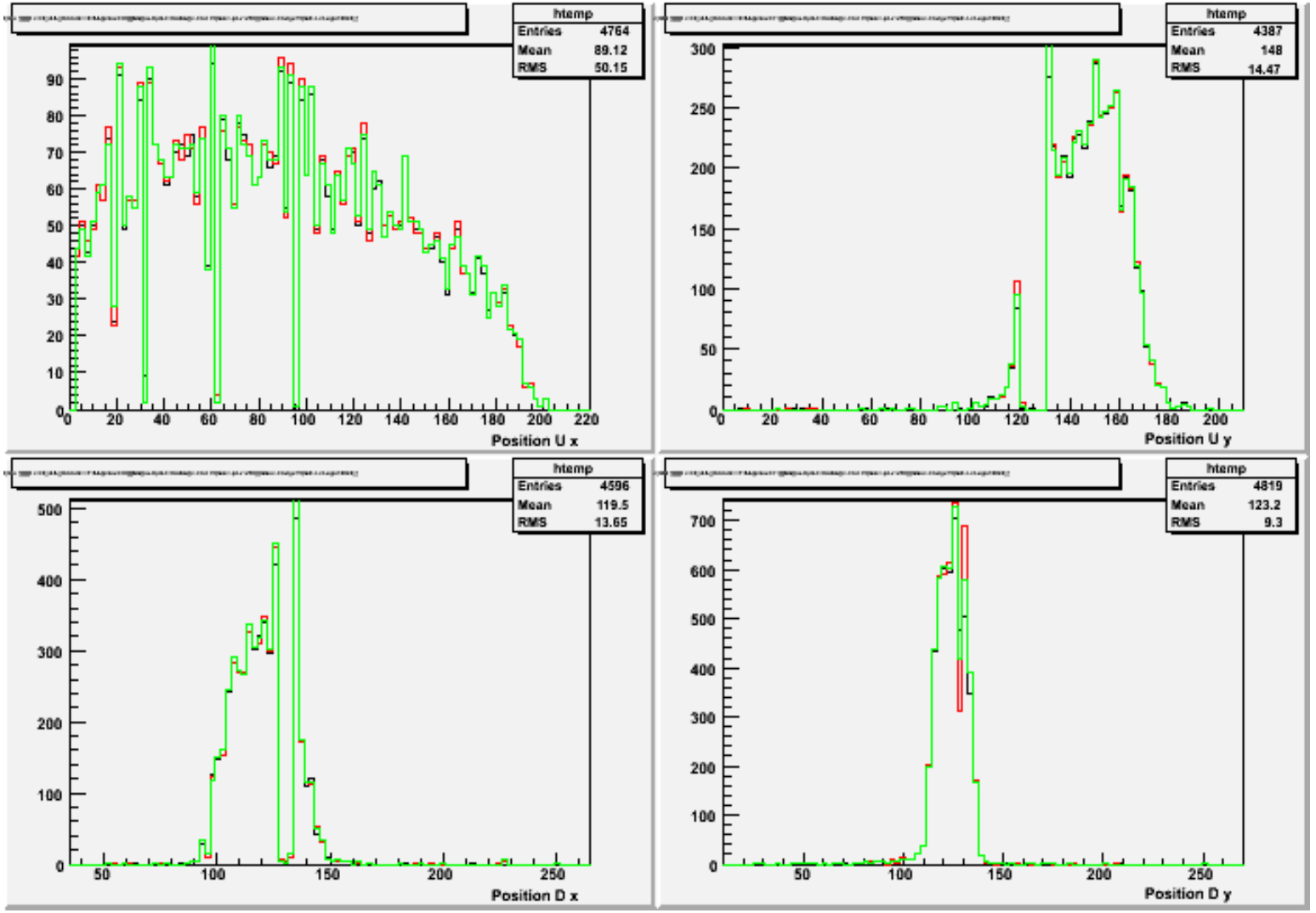








CERN Test: Beam Prof. - efficiency



Ux :	4773 [0.955]	4821 [0.964]	4817 [0.963] :	4755 [0.951]
Uy :	4399 [0.880]	4489 [0.898]	4449 [0.890] :	4384 [0.877]
Dx :	4616 [0.923]	4686 [0.937]	4715 [0.943] :	4520 [0.904]
Dy :	4881 [0.976]	4939 [0.988]	4927 [0.985] :	4850 [0.970]
Trk:	3916 [0.783]	4142 [0.828]	4123 [0.825]	